AMENDMENTS TO THE CLAIMS

Please cancel claims 53-111 without prejudice or disclaimer of the underlying subject matter, and amend claims 1-24, and 25-52 as set forth below:

1. (CURRENTLY AMENDED) A method for producing a semiconductor device, comprising the steps of:

forming an interconnection groove in an insulation film formed on a substrate;

stacking a copper film having unevenness on its surface corresponding to the step difference of the interconnection groove on the entire surface of the insulation film so as to bury the interconnection groove;

interposing an electrolytic solution comprising a chelating agent between a cathode member and the copper film functioning as an anode;

applying a voltage between the cathode member and the copper film to oxidize the surface of the copper film by anodic oxidation

forming a chelate film of oxidized copper;

selectively removing a projecting portion of the chelate film corresponding to unevenness of the copper film to expose the copper film of the projecting portion at its surface, wherein said chelate film is removed by wiping or mechanical polishing; and

repeating the above chelate film forming step and the chelate film removing step until the projecting portion of the copper film is flattened.

2. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 1, further comprising a step, after flattening the projecting portion of the copper film, of removing the chelate film formed on the surface of the copper film until the copper film stacked outside said interconnection groove is removed

3. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 2, further comprising a step of forming a barrier film comprising of a conductive material for preventing diffusion of said copper film to said insulation film so as to cover the insulation film and the inside of said groove after said forming an interconnection groove and before stacking the copper film.

4. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 1, wherein in the oxidizing step, a voltage is applied by using a

conductive polishing tool for removing a projecting portion of said chelate film as a cathode.

5. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 4, wherein an anode member contacting or near said copper film is made to be the anode and the copper film is made to be the anode through said electrolytic solution in said oxidizing step.

6. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 1, wherein in the oxidizing step, a voltage is applied by using a conductive electrode plate arranged parallel with said copper film.

7. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 3, wherein in said oxidizing step, a voltage is applied using as a cathode a conductive electrode plate arranged parallel with said copper film.

9. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 1, wherein in said step of removing a chelate film, said chelate film is removed by chemical mechanical polishing using a chemical polishing agent having a polishing abrasive.

10. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 3, wherein in said step of removing the chelate film, said chelate film is removed by wiping or mechanical polishing.

11. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 10, wherein in said step of removing the chelate film, said chelate film is removed by moving a polishing tool relative to the surface of the chelate film.

12. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 10, wherein in said step of removing the chelate film, said chelate film is removed by applying vibration to said substrate.

13. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 1, wherein in said step of removing the chelate film, said chelate film is removed by flushing said electrolytic solution.

14. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 1, wherein in said chelate film forming step and chelate film removing step, a current flowing through said cathode member and said copper film is monitored, and the progress of the polishing of the copper film is controlled in response to the magnitude of the current.

15. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 3, wherein in said chelate film forming step and chelate film removing step, a current flowing through said cathode member and said copper film is monitored, and the progress of the polishing of the copper film is controlled in response to the magnitude of the current.

16. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 3, wherein Ta, Ti, W, Co, TaN, TiN, WN, CoW, or CoWP is used for the material forming said barrier film in said step of forming the barrier film.

17. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 1, wherein a chelating agent forming a chelate film having a higher electrical resistance and a lower mechanical strength than said copper film is used as said chelating agent.

18. (CURRENLTY AMENDED) A method for producing a semiconductor device as set forth in claim 3, wherein a chelating agent forming a chelate film having a higher electrical resistance and a lower mechanical strength than said copper film is used as said chelating agent.

19. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 1, wherein quinaldine acid, glycin, citric acid, oxalic acid, or propionic acid is used as said chelating agent.

20. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 3, wherein quinaldine acid, glycin, citric acid, oxalic acid, or propionic acid is used as said chelating agent.

21. (ORIGINAL) A method for producing a semiconductor device as set

forth in claim 1, wherein,

in said step of forming the interconnection groove, a contact hole is formed for connecting an impurity diffusion region or interconnection formed at a layer below said insulation film with an interconnection formed in the interconnection groove along with the formation of an interconnection groove[[,]]; and

in said step of stacking the copper film, an interconnection groove is buried together with a contact hole with copper.

22. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 3, wherein

in said step of forming the interconnection groove, a contact hole is formed for connecting an impurity diffusion region or interconnection formed at a layer below said insulation film with an interconnection formed in the interconnection groove along with the formation of an interconnection groove, and

in said step of stacking the copper film, an interconnection groove is buried together with a contact hole with copper.

23. (CURRENTLY AMENDED) A polishing method for polishing an object having a copper film on the surface to be polished, comprising the steps of:

interposing an electrolytic solution including a chelating agent between a cathode member and the ~~polished~~ surface to be polished[[,]];

applying a voltage between the cathode member functioning as a cathode and the ~~polished~~ surface to be polished functioning as an anode to oxidize the surface of the copper film, and forming a chelate film of oxidized copper[[,]];

selectively removing a projecting portion of the chelate film corresponding to the shape of the copper film to expose the copper film of the projecting portion at its surface, wherein said chelate film is removed by wiping or mechanical polishing; and

repeating the above chelate film forming step and the chelate film removing step until the projecting portion of the copper film is flattened.

24. (ORIGINAL) A polishing method as set forth in claim 23, wherein

said polished object includes a stack of films comprised of different materials; and

in said chelate film forming step and chelate film removing step, a current

flowing from the surface of the polished object to said cathode member through said electrolytic solution is monitored to control the polishing process in response to the magnitude of the current.

25. (CURRENTLY AMENDED) A method for production of a semiconductor device, comprising the steps of:

forming at least a groove or hole in an insulation film formed on a substrate[[,]];

stacking a metal film on said insulation film so as to bury the groove or hole[[,]];

interposing an electrolytic solution between an electrode member and the metal film[[,]];

oxidizing the surface of the metal film through an anode oxidation process;

forming a chelate film of oxidized copper on the oxidated metal film;

removing the chelate film from the surface of the metal film, wherein said chelate film is removed by wiping or mechanical polishing; and

selectively repeating the above step of removing the chelate film until the unevenness of the surface of the metal film is reduced.

26. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 25, wherein said insulation film comprises a silicon dioxide film.

27. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 25, wherein said insulation film comprises a silicon nitride film.

28. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 25, wherein said insulation film comprises an insulation film having a dielectric constant less than a silicon dioxide film.

29. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 28, wherein said insulation film having a dielectric constant less than a silicon dioxide film comprises SiF, SiOCH, polyarylether, porous silica, or polyimide.

30. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 25, wherein

in said step of forming at least a groove or hole in an insulation film, either a groove or a hole is formed and

in said step of stacking a metal film on said insulation film, either the groove or the hole is buried.

31. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 25, wherein

in said step of forming at least a groove or hole in an insulation film, the hole is in communication with the bottom surface of the groove; and

in said step of stacking a metal film on said insulation film, both the groove and the hole are buried.

32. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 25, wherein in said step of stacking a metal film on said insulation film, at least one of Al, W, WN, Cu, Au, and Ag or an alloy of the same is stacked by either a chemical vapor-phase growing process or a physical vapor-phase growing process.

33. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 25, wherein in said step of stacking a metal film on said insulation film, at least one of Cu, Au, and Ag or an alloy of the same is stacked by an electroplating process.

34. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 25, wherein in said step of stacking a metal film on said insulation film, at least one of Co, Ni, CoWP, Cu, Au, and Ag or an alloy of the same is stacked by an electroless plating process.

35. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 25, wherein in said step of interposing an electrolytic solution between said electrode member and said metal film, an electrolytic solution including an electrolyte and an additive is interposed.

36. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 35, wherein said electrolytic solution comprises copper ions.

37. (ORIGINAL) A method for producing a semiconductor device as set

forth in claim 35, wherein said electrolytic solution comprises at least a brightener or a chelating agent as said additive.

38. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 25, wherein in said oxidizing step periodical pulse-like voltage is applied between the electrode member and the metal film.

39. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 38, wherein said applied periodical pulse-like voltage has a rectangular, sinusoidal, sawtooth wave, or PAM waveform.

40. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 38, wherein in said oxidizing step of a periodical pulse-like voltage is applied so that the current flowing through the cathode member and the metal film becomes small near the end of the process of removing the metal film.

41. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 38, wherein in said oxidizing step a periodical pulse-like voltage is applied so that the current flowing through the electrode member and the metal film changes in a step-like manner.

42. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 38, wherein in said oxidizing step a periodical pulse-like voltage is applied so that the current flowing through the electrode member and the metal film rises gradually at the beginning of the process of removing the metal film.

43. (CANCELED).

44. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 25, wherein in said step of wiping the surface of the chelate film, the chelate film is wiped by a wiping member having an air hole.

45. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 43, wherein in said step of wiping the surface of the chelate film, the surface of the chelate film is wiped by a wiping member comprising an elastic material.

46. (ORIGINAL) A method for producing a semiconductor device as set forth in claim 25, wherein said step of interposing an electrolytic solution between said electrode member and said metal film further includes a step of adjusting the electrolytic solution to a predetermined temperature.

47. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 46, wherein in said step of adjusting said electrolytic solution to a predetermined temperature, the temperature of the electrolytic solution is adjusted below 80°C.

48. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 25, further comprising a step of forming a barrier film for preventing diffusion of said metal film to said insulation film on the insulation film so as to bury said groove or hole after forming the groove or hole in the insulation film and before stacking the metal film on said insulation film,

wherein said metal film is stacked on the barrier film in the step of stacking the metal film on said insulation film.

49. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 48, wherein in said step of stacking said barrier film on said insulation film, at least one of Ti, TiN, Ta, TAN, W, WN, Co, CoWP, TiSiN, and NiWP or a stacked structure of the same is stacked.

50. (CURRENTLY AMENDED) A method for producing a semiconductor device as set forth in claim 25, wherein in said step of removing the surface of said chelate film, the step of chelate film removal is repeated until the metal film stacked outside said groove or hole is removed.

51. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 25, wherein in said oxidation step of and said step of removing the surface of the chelate film, the surface of the oxidized metal film is removed in a state of applying a predetermined voltage between the electrode member and the oxidized metal film.

52. (PREVIOUSLY PRESENTED) A method for producing a semiconductor device as set forth in claim 25, wherein in said oxidizing step and said step of removing the

surface of the chelate film, the surface of the chelate film is removed after a predetermined time period after applying a predetermined voltage between the electrode member and the metal film.

53. - 111. (CANCELED).